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ABSTRACT

Designed to help teachers of automotive services select the body of knowledge and experiences leading to the development of salable skills which might be necessary at various levels of complexity, this guide suggests an alignment of content, with teaching suggestions, for use in developing a vocational program to prepare youth and adults for employment. The content in the form of a chart of services to be performed is divided into three areas (service station, power plant services, and chassis services) covering the systems of assemblies in the automobile which need maintenance or repair. These system services are listed on four levels (basic, intermediate, advanced, and technical) intended to assist the teacher in selecting content with the appropriate depth or emphasis. Application, concepts, and teaching suggestions are included for each service. ("Application" refers to salable entry skills that should be mastered by the student, and "concept" refers to the principles, fundamentals, trade theory, and other items which relate to the services.) Safety education and safe operation are included as well as suggestions for use of special tools and equipment. (HD)

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AUTOMOTIVE SERVICE OCCUPATIONS

A Suggested Outline of Services and Levels
for the
Automotive Industries Occupations

(Reprint 1972)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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The University of the State of New York/The State Education Department
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FOREWORD

Automotive Service Occupations is the first of a series of publications dealing with the broadened curriculum field of Automotive Industries Occupations. This publication was developed to assist teachers in identifying and organizing content necessary for students preparing to enter the automotive service employment field.

Advisory committees have been convened on two occasions and development committees have worked two summers on this Automotive Industries project. Those who served on the advisory committees were Howard Daley, Thomas Edison Vocational and Technical High School, New York; Joseph A. Divone, Brooklyn High School of Automotive Trades; Harold Dowding, Syracuse Central Technical High School; Allen Fishken, William E. Grady Vocational High School, Brooklyn; Fredrick Gramet, Nassau County VEEB; Eugene Masucci, Suffolk County BOCES; John J. Nasal, Erie County BOCES #1; Thomas Onderdonk, Warren-Washington BOCES; Michael Ruvolo, Brooklyn High School of Automotive Trades; Robert Schumacher, Agricultural and Technical College, Morrisville; Francis Scott, Newburg Free Academy, Newburg; Robert F. Stampf, Newfield High School, Selden. The project was initiated by C. Thomas Olivo, Director, Division of Industrial Education. Many persons in the Education Department helped give general direction and guidance at the advisory committee meetings and during the development stages.

During the summer of 1966, a workshop was held on the campus of State University College at Oswego. During that time, Harold Dowding, John Nasal, Robert Stampf, and Norman Mathien, Burgard Vocational High School, Buffalo, developed preliminary material which included the Occupational Analysis Chart showing the gamut of automotive service jobs as the central core within the automotive industries occupations, with related occupations, and occupational extensions identified. Dr. Gordon McMahon, Director of the Division of Vocational Technical Education at the College, acted as general coordinator.

It was the central core of Service Occupations which the second team of Francis Scott, Thomas Onderdonk, Howard Daley, Fredrick Gramet, and Clayton Fields of Edison Technical High School, Rochester, used as a basis for their development as they worked during the summer of 1967 to prepare the Service Occupations material which is presented here.

More specific indications as to how this material can be used in the occupational program are given in the Introduction.

The material will be useful to teachers of automotive service occupations in selecting the scope and depth of their instructional program.

As a curriculum function two bureaus of the Curriculum Development Center have been involved. Earl Hay, supervisor of vocational curriculum in the Bureau of Secondary Curriculum Development acted as general coordinator of the two-year project. Nelson Maurer, associate in vocational curriculum in the Bureau of Continuing Education Curriculum Development worked with the second committee and with a further project to develop adult teacher guides in three specific areas of automotive services. These guides will be released at a later date.

Guidance and direction at various stages in the project were provided by the Bureau of Trade and Technical Education through the successive services of Henry Mandel, E. A. Smith, and Edward Shattuck, associates in industrial education.

This suggested outline of services is being distributed to all schools in New York State offering a vocational education program in the Automotive Industries in the hope that they will review it and assess where and how it can be adapted to their own program. Any constructive suggestions concerning this material should be forwarded to the Bureau of Secondary Curriculum Development for consideration in a revised edition.

Chief, Bureau of Secondary
Curriculum Development

Herbert Bothamley
Chief, Bureau of Continuing
Education Curriculum Development

Gordon E. Van Hooft
Director, Division of
School Supervision

INTRODUCTION

Automotive industries occupations include all of the clusters of occupations concerned with maintenance and repair of all types of automotive vehicles. Employment possibilities exist at levels ranging from the entry level to those requiring a high degree of technical skill, into engineering and scientific.

These occupations are classified into broad categories. The most familiar are included in the *Automotive Service Occupations* which deals with the general maintenance and repair of the several systems or groups of component parts in an automobile. *Auto Damage Correction Occupations* deals with the appearance of the vehicle and the repair of damaged metal, glass, fabric, and finish.

There are areas of specialization where advanced knowledge and skills are necessary for the complete adjustment, repair, and rebuilding of one of the complex systems.

Automotive industries require support occupations in the related fields of business, sales, stock management, and other related areas.

This publication deals only with the *Automotive Service Occupations*. It is designed to help teachers of automotive services select the body of knowledge and experiences leading to the development of salable skills which might be necessary at various levels of complexity. It does not suggest a course of study; but rather an alignment of content, with teaching suggestions to cover this content, for use in developing a vocational program to prepare youth and adults for employment. It does suggest breadth of coverage of all areas, followed by depth of specialization in any one system.

The content in the form of a chart of services to be performed is divided into three areas; *Service Station, Power Plant Services,* and *Chassis Services.* Into these sections fall the systems or assemblies in the automobile which need maintenance or repair. These systems are listed on four levels; *Basic, Intermediate, Advanced,* and *Technical.* This arrangement is intended to assist the teacher in selecting content with the appropriate depth or emphasis.

Auto body services have not been developed in this instructional guide. This phase of the automotive industry is important but distinctly different in its requirements, and will be developed separately.

At the advanced level material may be drawn from more than one column in order to accommodate certain phases of the industry. One example of this would be engine tuneup and diagnosis, which would have content material drawn from the fuel and electrical sections.

The instructional guide was developed from the lists of services to be performed at each level. *Application, Concepts,* and *Teaching Suggestions* are included for each service.

The heading *Application* shows the salable entry skill that should be mastered by the student. The heading *Concepts* refers to the principles, fundamentals, trade theory, and other items which relate to the services. Selected *Teaching Suggestions* which may be helpful in presenting the material are covered.

Safety education and safe operation have been included in the guide as well as suggestions for use of special tools and equipment. The use of basic hand tools and the teaching of general safety have been left to the discretion of the teacher.

The intermediate level mechanical services, under *Service Station,* have not been developed in this occupational service guide. The material for this section may be selected from all columns on the elementary level as facilities and teaching situations dictate.

This instructional guide should assist in the preparation of well-qualified automotive service people for several levels of job competency and complexity.

Carl G. Benenati
Chief, Bureau of Trade and Technical Education

Robert H. Bielefeld
Director, Division of Occupational Education Instruction

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OCCUPATIONAL ANALYSIS FOR THE AUTOMOTIVE INDUSTRIES

Listed below are representative job titles in the Automotive Industries Occupations. The Service Occupations listed represent jobs from the entry level requiring limited skills, to the technical level of automobile mechanics requiring greater skill and experience.

The column of Related Occupations identifies job titles where knowledge of automobiles is important but where other specific skills are necessary in the performance of the job.

The column of Occupational Extensions lists job titles requiring additional experience or training in specialized areas.

The Dictionary of Occupational Titles, Volume I and II, third edition, was used as reference in compiling this list. D.O.T. numbers and job definitions can be secured from this reference. It is not intended that this be an all-inclusive list, but is offered to help the instructor in Automotive Industries Occupations identify a variety of stages of entrance into employment in the field.

OCCUPATIONAL EXTENSIONS	SERVICE OCCUPATIONS	RELATED OCCUPATIONS
Automobile engineer	Automobile mechanic	Machinist, automotive
Draftsman, mechanical	Transmission mechanic	Construction equipment mechanic
Auto-body design detailer	Automobile refrigeration mechanic	Farm equipment mechanic
Automotive test shop supervisor	Tuneup man	Motorboat mechanic, outboard motor mechanic
Auto shop foreman	Carburetor man	Automobile diesel engine tester
Shop estimator	Front end man	Auto parts man; auto parts clerk
Dynamometer tester, motor manufacturing	Automobile refrigeration mechanic	Auto body repairman
Automotive maintenance-equipment serviceman	Brake repairman, automotive	Automobile upholsterer
Diesel mechanic	Electrician, automotive	Battery repairman
Fuel injection serviceman	Engine repairman, service	Painter, automobile
Bulldozer operator	New car get ready man	Automobile seat-cover-and-convertible-top installer
Tractor operator	Automatic window-seat-and-top-lift repairman	Frame repairman
Automobile repair service salesman	Automobile service mechanic	Truck body builder
Salesman, automobile	Automobile mechanic helper	Electric motor repairman, auto generator, and starter
Salesman, auto parts	Brake adjuster	Brake drum lathe operator
	Used car renovation	Main bearing borer
	Automobile bumper straightener	Boring machine operator, production
	Tire repairman	Automobile slip cover installer
	Automobile service station attendant	Automobile accessory installer
	Automobile self service attendant	Squeak, rattle, and leak man
	Automobile cleaner	Automotive manufacturing and assembling production worker
	Steam cleaner	

LEVEL	SERVICE STATION	POWER PLANT							
	Automobile Service	Engine Assembly Service	Cooling System Services	Lubrication System Services	Fuel System Services	Electrical Systems Services: Ignition	Electrical Systems Services: Battery and Starting	Electrical Systems Services: Charging	Exhaust System Services
BASIC	Introduction to the Service Station Driveway Lubrication Maintenance Appearance	Engine Fundamentals Oil Pan Harmonic Balancer Exhaust Manifold Head Valve Valve Operation Valve Mechanism	Radiator Hose Pressure Cap Belt	Oil Filter Crankcase Breather Crankcase	Air Cleaner Fuel Filter Fuel Pump Fuel Line	Electrical Fundamentals Ignition Switch Spark Plug Cap and Rotor Secondary Wiring	Battery Battery Cable	Belt Generator Exchange Alternator Exchange	Exhaust System
INTERMEDIATE	Mechanical Services to be drawn from elementary service level of Power Plant and Chassis as needed	Engine Exchange Cylinder Piston Assembly Bearings Flywheel	Thermostat Water Pump Expansion Plug Temperature Indicator	Oil Pump Oil Passage and Line	Fuel Tank Carburetor Intake Manifold	Primary Wiring Breaker Point and Condenser Distributor Advance Mechanism Coil	Starter Motor Starter Drive Starter Relay and Solenoid Starter Switch	Generator Overhaul Alternator Overhaul Regulator Charging Indicator	Exhaust Manifold and Heat Control Valve
ADVANCED	Management Supervision	Block and Machine Shop Crankshaft Camshaft	Cooler Line Fan Assembly Heater Radiator Repair	Engine Oil Cooler Oil Pressure Indicator Crankcase Emission Control	Fuel Injection Exhaust Emissio Control	Distributor Overhaul Transistor Ignition	Armature Field Coil Test Bench	Test Bench	
TECHNICAL		Technical Engine and Supportive Services		Technical Petroleum Products Services		Technical Electrical Services			

CHASSIS										LEVEL
Electrical Services	Wheel, Hub and Tire Services	Brake Services	Springs, Shocks, Stabilizing Device Services	Front Suspension And Steering Services	Clutch Services	Manual Transmission Services	Automatic Transmission Services	Drive Line Services	Drive Axle Assembly Services	
Electrical Fundamentals Lighting Horn	Tire And Wheel Wheel Bearing	Brake Inspection and Adjustment Brake Shoe	Shock Absorber	Front Suspension Inspection Ball Joint	Clutch Adjustment	Manual Transmission Mount	Inspection	Universal Joint Lubrication and Replacement	Inspection Seals Differential Assembly Exchange	BASIC
Directional Light Wiper	Wheel Balancing Axle Bearing and Seal	Drum and Shoe Hydraulic Unit Exchange Hydraulic Unit Reconditioning	Leaf Spring Coil Spring Torsion Bar Sway Bar and Stabilizer	King Pin Steering Linkage Manual Steering Gear Alignment Front Suspension Overhaul	Clutch Overhaul	Manual Transmission Linkage Manual Transmission Exchange Manual Transmission Overhaul	Automatic Transmission Exchange Seals	Center Bearing Drive Shaft	Differential Assembly Overhaul	INTERMEDIATE
Power Accessory Headlight Beam Control Speed Control Air Conditioning and Ventilating	Hub	Power Brake Disc Brake	Spring Assist	Power Steering	Hydraulic Cylinder (See Brake Cylinder Service)	Overdrive Transfer Case Power Take-off	Automatic Transmission Linkage and Band Adjustment Automatic Transmission Overhaul		Transaxle Front Drive	ADVANCED
Technical Comfort and Safety Services					Technical Power Transmission Services					TECHNICAL

SERVICE STATION

Automobile Service

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SERVICE STATION

LEVEL	Automobile Service	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Introduction To The Service Station	Develop good customer relations	Career opportunities	Discuss career opportunities
		Develop merchandising skills	The petroleum industry	Discuss the petroleum industry (present and future)
		Develop maintenance skills	The service station business	Discuss the service station business
			The future of the service station business	
			Service station safety	Emphasize safety
				Help students develop good customer relations, maintenance, and merchandising skills
Basic	Driveway Services	Pump gasoline	Characteristics of fuel	Discuss characteristics of fuels
				Discuss and demonstrate fuel pumping. Emphasize safety.
		Check oil, water, battery, and under hood items	S.A.E. and A.P.I. oil designations	Review S.A.E. and A.P.I. oil designations
			Battery water	Demonstrate under hood services
		Check tires	Tire pressures	Explain tire applications and pressures and demonstrate tire checking
		Clean windshield and headlights		
		Replace wiper blade and arm assemblies	Types and construction of wiper blades and arms	Discuss wiper blade and arm types and demonstrate service
Basic	Lubrication Services	Change oil	Types of oils	Review oil ratings
		Change filter	Types of lubricants	Discuss oil types
		Lubricate car	Construction of oil filters	Discuss oil filter function, construction, and application
		Check all fluid levels		Demonstrate oil and filter changing

LEVEL	Automobile Service	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Lubrication Services (Cont'd)	Service wheel bearings		Discuss types of chassis lubricants and gear lubricants Demonstrate lubrication procedure Demonstrate fluid level checking
Basic	Maintenance Services	Clean floors and walls Clean driveway areas Clean bay areas Clean washrooms Replenish washroom supplies Maintaim service station equipment	Oil absorbent compounds Floor and wall cleaning materials Washroom cleaning materials Washroom supplies	Explain use of oil and grease absorbing compounds Discuss floor and wall cleaners Discuss and demonstrate washroom cleaning materials Discuss types and use of washroom supplies Demonstrate maintenance procedures
Basic	Appearance Services	Wash car Clean and vacuum interior Clean and polish exterior Steam clean engine and other components	Types of wash materials Washing equipment Upholstery cleaners Vacuum equipment Types of compounds and waxes Steam cleaning equipment	Discuss types of wash materials and equipment Demonstrate car washing Discuss and demonstrate upholstery cleaning Explain and demonstrate the use of vacuum equipment Discuss types and application of compounds and waxes Demonstrate use of steam cleaning equipment Emphasize safety

SERVICE STATION

LEVEL	Automobile Service	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Mechanical Services	To be drawn from Elementary service level of Power Plant and Chassis as needed		
Adv.	Management Services	Keep sales records Keep customer records Keep inventory records Supervise personnel Train personnel Purchase supplies, materials, and equipment	Personnel management and training Billing and purchasing Types of forms and records Types of service station leases Credit references	Discuss sales, customer, and inventory records and show application of each Explain personnel management and training Discuss billing and purchasing procedures Show sample bills, statements, and purchasing forms Discuss various types of service station leases Discuss affiliation with local credit bureaus and collection agencies
Adv.	Supervision Services	This training is generally provided for by most major oil companies in their Advanced Management Training courses. This includes such areas as Merchandising, Management, Real Estate Leasing and Purchasing; and the purchase of equipment, tools, supplies, and materials.		

POWER PLANT

Engine Assembly

Cooling System

Lubrication System

Fuel System

Ignition System

Battery and Starter

Charging System

Exhaust System

POWER PLANT

LEVEL	Engine Assembly	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Engine Fundamentals		Four-stroke-cycle theory	Explain in-line types of engines
			Two-stroke-cycle theory	Discuss "L" head, overhead, and "F" head types
			Cylinder arrangement	
			Valve arrangement	Show visual aids and discuss engine types
			Diesel engine principles	Explain operation of diesel engines
			Internal combustion engine measurements	Discuss bore, stroke, displacement, compression ratio
			Horsepower and torque	Discuss horsepower and torque
Basic	Oil Pan Service	Remove oil pan	Construction and function	Review oil change procedures
		Clean and inspect oil pan	Types of gaskets	Explain removal procedure
		Replace oil pan	Kinds of solvents	Discuss use of cleaning solvents
			Types of seals	Explain replacement procedures and precautions
Basic	Harmonic Balancer Service	Remove harmonic balancer	Construction and function	Stress proper puller application
		Inspect harmonic balancer	Nomenclature	Explain key installation and precautions
		Replace harmonic balancer		
Basic	Exhaust Manifold Service	Remove exhaust manifold	Construction and function	Demonstrate frozen bolt removal
		Replace exhaust manifold	Types of gaskets	
Basic	Head Service	Remove, clean, and inspect head	Construction and function	Explain removal procedure
		Replace head	Types of heads	Stress safe cleaning methods
			Gasket materials	Discuss inspection
				Explain torque procedure

LEVEL	Engine Assembly	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Valve Service	Remove valves Clean valves, stems, and faces Inspect valves for wear Reface and reseat valves Replace valves	Valve function and construction Valve springs Specifications (valve and seat) Valve seating Types of rotators	Show proper use of lifters and spring compressors Stress safe cleaning methods for valves and guides Demonstrate use of valve and seat refacers Explain proper replacement of valves and springs
Basic	Valve Actuator Service	Remove rocker arm assembly and push rods Disassemble rocker arm assembly Inspect rocker arms, shafts, and push rods Recondition rocker arms Assemble and install parts	Valve lifter lubrication Types of rocker arm adjustments	Show removal procedure Demonstrate disassembly Discuss inspection Show how to recondition rocker arms Review torque procedures
Basic	Valve Mechanism Service	Remove valve lifters Clean, inspect, and overhaul hydraulic lifters	Lifter construction and function	Explain lifter function and construction Discuss removal procedure Demonstrate disassembly and inspection procedures
Int.	Engine Exchange Service	Remove engine assembly Exchange external components Replace engine assembly	Types of engine mounts Types of lifting equipment	Review exchange of external components and coolant draining Emphasize safe use of lifting equipment Explain proper procedure

ELEM	Engine Assembly	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Cylinder Service	Remove ridge Hone and inspect cylinders	Block and cylinder construction Cylinder wear Measuring devices	Show use of ridge reamer Explain block construction Show use of cylinder hone Stress proper inspection Show use of measuring devices
Int.	Piston Assembly Service	Remove piston assembly Remove rings Clean and inspect piston assembly Remove rod and pin, and inspect Reassemble	Piston and pin nomenclature Piston construction Ring function and construction Rod function and construction	Explain proper removal and disassembly of piston and rod assembly Discuss function and constrution of piston rings, rods, and pins Discuss piston reconditioning Explain correct assembly procedure
Int.	Bearing Service	Remove, inspect, and replace bearings	Bearing function, construction, and material Measuring devices Bearing sizes	Explain removal procedures Explain bearing function, construction, material, and sizes Show proper use of measuring devices Demonstrate proper installation Explain and show various locking devices Discuss diagnostic procedures
Int.	Flywheel Service	Remove flywheel Inspect and reface flywheel Install ring gear Replace flywheel	Function and construction of flywheel and ring gear Torque specifications	Explain function and construction of flywheel and ring gear Review tightening procedure Discuss proper replacement procedure

LEVEL	Engine Assembly	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Adv.	Block & Machine Shop Service	Rebore cylinders Mill heads and block Grind crankshaft Weld and grind repairs	Block construction Head construction Crankshaft construction Cam shaft construction	Explain block construction and materials Show how to use boring equipment Discuss milling of heads Discuss crankshaft materials and construction Discuss camshaft construction and materials Discuss crankshaft and camshaft grinding Take class on field trip to auto-machine shop
Adv.	Crankshaft Service	Remove crankshaft Inspect and measure crankshaft Replace seals Replace shaft	Crankshaft construction and function Cap and rod identification Measuring devices Seal function and types	Explain crankshaft construction and function Discuss cap and rod markings Review micrometers Show and discuss seals Explain in-car seal replacement
Adv.	Camshaft Service	Remove camshaft Inspect and measure camshaft Replace camshaft	Camshaft construction and function Types of camshafts	Discuss camshaft design

LEVEL	COOLING SYSTEM	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Radiator Service	Inspect radiator Drain and flush radiator Winterize cooling system Remove and replace radiator	Types of cooling systems Radiator function Types of radiators Cleaning agents Types of antifreeze solutions and additives	Discuss liquid and air cooling Discuss radiator function Explain types of radiators Explain uses of flushing solutions Discuss solutions and additives Demonstrate use of cooling system leak detectors
Basic	Hose Service	Inspect hoses Remove and replace hoses	Hose function and construction Hose types Types of hose clamps	Explain hose inspection Show types of hoses and clamps Demonstrate hose replacement Stress proper use of tools
Basic	Pressure Cap Service	Remove cap Inspect and test cap	Construction and function of radiator caps	Demonstrate cap removal Explain cap construction and function
Basic	Belt Service	Inspect belt Remove and replace belt	Types, function, and construction of belts	Discuss inspection Explain types and functions Demonstrate replacement procedure Stress safety
Int.	Thermostat Service	Remove thermostat Inspect thermostat and housing Replace thermostat	Thermostat function Types of thermostats	Explain types and functions of thermostats Discuss removal and replacement Demonstrate thermostat testing
Int.	Water Pump Service	Remove water pump Replace water pump	Pump construction and function Gaskets and sealers	Explain how to diagnose pump problems

LEVEL	COOLING SYSTEM	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Water Pump Service (Cont'd.)			Demonstrate removal and replacement Discuss gaskets and sealers
Int.	Expansion Plug Service	Inspect expansion plugs Remove and replace	Types of expansion plugs and function	Explain plug replacement
Int.	Temperature Indicator Service	Test temperature indicator units Remove and replace units	Operation and construction of temperature indicators Types of units	Explain operation and construction Show various types Discuss test procedures Explain proper installation or service
Adv.	Cooler Line Service	Inspect cooler lines Repair or replace cooler lines	Purpose of cooler lines Types of materials	Explain function Discuss repair procedure Demonstrate use of flaring tools
Adv.	Fan Assembly Service	Check fan assembly Remove assembly Replace assembly	Fan function and construction Thermostatic fan operation Thermostatic controlled shutter operation	Explain fan function Discuss thermostatic fans Demonstrate fan replacement Stress safety
Adv.	Heater Service	Diagnose heater problems Remove heater assembly Check and repair heater core Replace thermostatic control valve	Heater operation and construction Control valve principles and construction	Discuss heater assemblies Explain control valve assemblies Discuss removal and repair procedures

LEVEL	COOLING SYSTEM	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Adv.	Radiator Repair Service	Test for leaks Test radiator flow Clean and repair radiator	Radiator materials Cleaning materials Repair materials	Review elementary radiator concepts Discuss radiator materials Explain cleaning and repair materials Demonstrate radiator testing and repair

LEVEL	Lubrication System	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Oil Filter Service	Remove oil filter assembly	Oil filter function and construction	Discuss filter function and construction
		Clean filter housing	Types of filter materials	Explain and show filter materials
		Replace filter assembly	Types of filter systems	Discuss types of filters (bypass - full flow)
Basic	Crankcase Breather Service	Remove, clean, and replace	Crankcase ventilation	Discuss crankcase ventilation Explain and demonstrate service procedures
Basic	Crankcase Service	Check oil level	S.A.E. oil grades	Demonstrate checking and changing procedures
		Drain oil	A.P.I. oil types	Point out plug-gasket material and proper tightening procedure
		Replace plug and refill to proper level	Oil function	Explain use of lubrication charts
			Plug gasket materials	Discuss S.A.E. and A.P.I. ratings
Int.	Oil Pump Service	Diagnose oil pressure problems	Types of oil pumps	Demonstrate diagnostic procedure
		Remove and inspect pump, pressure regulator, and strainer	Oil pump operation	Show types of pumps and explain construction
		Repair or replace assembly		Discuss oil pump operation
				Demonstrate removal, inspection, and replacement
Int.	Oil Passage And Line Service	Diagnose oil passage problems	Oil galleries and lines	Explain and show how to diagnose problems
		Clean oil lines and passages		Demonstrate how to clean oil galleries
Adv.	Engine Oil Cooler Service	Inspect cooler assembly clean cooler unit, and repair leaks	Oil cooler function and construction	Explain function and construction of oil coolers Demonstrate service procedure

LEVEL	Lubrication System	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Adv.	Oil Pressure Indicator Service	Test indicator units	Operation and construction of oil pressure indicators	Explain operation and construction
		Remove and replace units	Types of units	Show various types Discuss test procedures Explain proper installation or service
Adv.	Crankcase Emission Control Service	Remove, clean, or replace positive crankcase ventilator	Forced ventilation	Discuss forced ventilation Show P.C.V. devices and explain operation and construction Demonstrate service procedures

LEVEL	Fuel System	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Air Cleaner Service	Remove and replace air cleaners	Types of air cleaners	Explain and show various types
		Inspect and test	Purpose and operation of air cleaners	Explain test procedures
		Clean or replace element		Explain service of various types
				Stress proper procedures
				Stress viscosity and oil level (oil bath type)
Basic	Fuel Filter Service	Remove and replace fuel filter	Filter operation and construction	Stress proper installation procedures
		Test fuel filter	Types of filters	Explain function and types
		Clean fuel filter		
Basic	Fuel Pump Service	Make fuel pump tests	Fuel pump operation	Stress proper use of tools
		Remove and replace fuel pump	Types of fuel pumps	Stress proper installation procedures
			Types of test equipment	Show methods of testing pressure, vacuum, and volume
			Composition of fuels	Explain types of fuel pumps and stress safety
Basic	Fuel Line Service	Inspect fuel lines	Types of fuel lines	Stress proper use of fuel line tools
		Remove and replace lines	Effect of vapor lock	Discuss vapor lock prevention and correction
		Make up fuel lines		Show how to assemble fuel lines
Int.	Fuel Tank Service	Drain fuel tank	Construction and function of fuel tanks	Stress fire hazards
		Remove fuel tank	Sending unit operation	Explain frozen bolt removal
		Clean and repair fuel tank	Fuel tank caps and vents	Demonstrate soldering procedures
		Replace sending unit		Explain methods of venting
		Replace fuel tank		

LEVEL	Fuel System	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Carburetor Service	Remove, replace, and adjust carburetor Clean and overhaul carburetor	Carburetor principles Carburetor construction Carburetor circuits	Demonstrate service procedures Demonstrate carburetor cleaning and overhauling Discuss cleaning agents Explain and show manifold heat controls
Int.	Intake Manifold Service	Remove and replace intake manifold Clean and inspect manifold	Air and fuel distribution and atomization	Demonstrate service procedures Discuss manifold principles and functions
Adv.	Fuel Injection Service	Diagnose and service fuel meter, air meter, intake manifold, and nozzles	Fuel injection fundamentals and operation Injection system components	Explain operation of fuel injection Discuss service procedures Demonstrate removal, installation, and adjustments
Adv.	Exhaust Emission Control Service	Early stages of development and lack of specifications and detail make planning the presentation of exhaust emission control systems impossible at this time.		

POWER PLANT - ELECTRICAL SYSTEMS

LEVEL	Ignition System	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Ignition Switch Service	Test switch and circuit Remove and replace ignition switch assembly	Switch function and construction	Discuss testing procedures Demonstrate removal and installation
Basic	Spark Plug Service	Diagnose spark plug problems Remove, clean, test, and replace spark plugs	Purpose, function, and construction of spark plugs Heat ranges	Discuss spark plug operation, function, and construction Demonstrate installation procedure Demonstrate cleaning and adjusting techniques
Basic	Cap And Rotor Service	Inspect distributor cap and rotor Clean or replace units	Cap and rotor function and construction	Demonstrate inspection and replacement procedure Discuss cap and rotor function and construction
Basic	Secondary Wiring Service	Test and inspect wiring Replace secondary wiring	Types of secondary wiring	Stress proper removal and replacement of wires Discuss function and construction
Int.	Primary Wiring Service	Test primary circuit	Construction and components of primary circuit Resistors - types and function	Discuss test procedures for resistors Discuss voltage drop Discuss resistor purpose and function in primary circuit
Int.	Breaker Points And Condenser Service	Inspect and test points and condenser	Point construction and function Condenser construction and function	Discuss point and condenser construction and function Demonstrate service procedure

LEVEL	Ignition System	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Coil Service	Test, remove, and replace ignition coil	Coil construction and fundamentals of operation Testing devices	Discuss test procedures and demonstrate installation Discuss coil construction and operation
Adv.	Distributor Overhaul Service	Test distributor Remove, replace, and recondition distributor	Distributor function and construction Testing devices	Explain and demonstrate test procedures Discuss distributor construction and function Demonstrate service procedures
Adv.	Transistor Ignition Service	Test transistor circuits Test components Replace components	Transistor ignition operation Transistor principles	Explain transistor ignition fundamentals Demonstrate test procedures Explain and demonstrate service procedure

LEVEL	Battery And Starter	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Battery Service	Inspect and test battery Clean and fill battery	Battery construction and materials Battery ratings	Discuss battery construction and ratings Stress battery safety Discuss chemical action Demonstrate service procedure Stress proper polarity Demonstrate charging procedure
Basic	Battery Cable Service	Check cables Clean terminals Replace cables	Types of chargers Cable construction and sizes Corrosion	Demonstrate cable service Show special tool use Explain cable construction and sizes Discuss effects of corrosion
Int.	Starting Motor Service	Test starter circuit Remove starter Overhaul starter Test components Replace starter	D.C. Motor Operation and construction Types of test equipment	Explain D.C. motor construction and operation Demonstrate circuit tests Explain removal procedures Point out the use of special tools Demonstrate starter overhaul Demonstrate test procedures
Int.	Starter Drive Service	Test starter drive Remove starter drive Replace starter drive	Torque and gear reduction Types of drives	Explain gear reduction Demonstrate testing Discuss types of starter drives Demonstrate replacement

POWER PLANT - ELECTRICAL SYSTEMS

LEVEL	Battery And Starter	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Starter Relay And Solenoid Service	Test switch circuit or relay Test solenoid circuit	Construction of components Electromagnetism Switch and solenoid circuits Neutral safety switch function	Demonstrate test procedure Explain components and operation Discuss magnetism Explain neutral safety switch function
Adv.	Armature Service	Test armature Recondition armature	Armature construction Purpose of armature	Demonstrate test procedures Explain armature concepts and construction Discuss machining operations
Adv.	Field Coil Service	Test field coils Remove and replace field coils	Field coil construction and function	Discuss electrical concept of field coils Explain mechanical operations while servicing field coils
Adv.	Test Bench Service	Check units on test bench Diagnose problems	Purpose of test unit Operation of tester	Discuss operation and purpose of test unit Point out how to read gauges and diagnose problems

POWER PLANT - ELECTRICAL SYSTEMS

LEVEL	Charging	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Belt Service	Inspect belt Adjust belt Replace belt	Belt functions Types of belts	Explain belt inspection Discuss adjustment procedure Demonstrate belt replacement
Basic	Generator Exchange Service	Test generator circuit Remove and replace generator	Types and function of generator testers	Demonstrate test procedure Explain replacement procedure Explain polarizing
Basic	Alternator Exchange Service	Test alternator circuit Remove and replace alternator	Types and function of alternator test instruments	Demonstrate test procedure Explain replacement procedure Stress polarity
Int.	Generator Overhaul Service	Test generator circuit Remove generator Overhaul generator Test components Replace generator Service armature	Generator operation and construction Types of test equipment	Explain generator construction and operation Demonstrate circuit tests Explain removal procedures Explain and demonstrate use of special tools Demonstrate operation of armature lathe
Int.	Alternator Overhaul Service	Test alternator circuits Disassemble alternator Test components Assemble alternator	Alternator principles Diode function and construction	Explain alternator principles and construction Explain diode function and construction Discuss test procedures Demonstrate overhaul procedure

LEVEL		APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Regulator Service	Test regulator circuits Inspect, clean, and adjust regulators	Cutout units Voltage control units Current regulator units Transistorized regulators	Explain test procedure Demonstrate service procedures Discuss internal units Explain transistorized regulators Discuss internally and externally grounded circuits
Int.	Changing Indicator Service	Test charging indicator units Replace defective components	Indicator function	Demonstrate test procedure Discuss indicator fundamentals Demonstrate and explain ammeter replacement
Adv.	Test Bench Service	Test generator, alternator, or regulator on test bench	Test bench principles and operation	Review test unit operation Demonstrate test procedures

LEVEL	Exhaust System	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Exhaust System Service	Inspect exhaust system Replace exhaust pipe Replace muffler Replace resonator Replace tail pipe Replace clamps and hangers	Effects of carbon monoxide on humans Exhaust system operation Exhaust system deterioration	Discuss exhaust system operation and deterioration Demonstrate unit replacement Demonstrate the use of special tools and torches Stress personal safety Stress fire safety
Adv.	Exhaust Manifold And Heat Control Service	Inspect exhaust manifold and heat control valve Replace manifold gaskets Replace manifold heat control valve Replace exhaust manifold	Exhaust manifold function and construction Operation and purpose of exhaust heat control valve Types of gaskets	Explain manifold and gasket inspection Discuss heat control valve function Stress maintenance Demonstrate service procedures

CHASSIS SERVICES

Electrical Service

Wheel, Hubs, and Tires

Brakes

Springs, Shocks, and Stabilizing Devices

Front Suspension and Steering

Clutch

Manual Transmission

Automatic Transmission

Drive Line

Drive Axle Assembly

CHASSIS

LEVEL	Electrical Service	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Electrical Fundamentals	Test series and parallel circuits Make resistance and voltage drop tests	Electrical terms and definitions Ohm's Law Series and parallel circuits Conductors and insulators Fundamentals of magnetism Types and function of switches Types and function of breakers and fuses	Distribute information sheet and discuss electrical definitions Explain and demonstrate series and parallel circuits Discuss conductors and insulators Demonstrate fundamentals of magnetism Demonstrate use of voltmeters, ammeters, and ohmmeters Discuss types and function of switches Discuss types and function of circuit breakers and fuses
Basic	Lighting Service	Replace light bulbs Replace and adjust sealed beam units Replace control switches Replace stoplight switch Diagnose lighting circuit problems	Construction and function of lighting circuits Construction and function of switches	Discuss headlight circuit, taillight circuit and switches Demonstrate methods of diagnosing light and switch problems Show how to change bulbs and align headlights Review state inspection laws
Basic	Horn Service	Remove and replace horn Test horn circuit Replace horn relay Service steering column switch	Construction and types of horns, relays, and switches	Demonstrate horn and relay replacement Discuss horn construction and types Discuss horn frequencies

LEVEL	Electrical Service	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Directional Light Service	Diagnose directional light circuit problems Replace flasher Replace bulbs Replace directional light switch	Directional light circuits Emergency flashers	Discuss directional light circuit problems Stress proper grounding Demonstrate flasher replacement Demonstrate switch service
Int.	Wiper Service	Diagnose wiper circuit problems Replace wiper motor Repair wiper motor Replace wiper switch Replace wiper transmission Adjust wiper action Service washer assembly	Wiper circuits Wiper motors and controls Construction and operation of washers	Discuss wiper circuit problems Demonstrate motor replacement and repair Demonstrate wiper switch and transmission replacement Demonstrate adjustment procedure Discuss motors and controls
Adv.	Power Accessory Service	Diagnose power seat, window, antenna, trunk, and convertible top circuits Replace or repair defective components	Power assist circuits Power controls Electric motor construction and operation	Discuss diagnostic procedures Demonstrate replacement and repair service Discuss power circuits Discuss motors and controls
Adv.	Headlight Beam Control Service	Adjust electric eye Diagnose beam control circuit problems Replace or repair defective components	Construction and operation of automatic beam control devices	Discuss speed control construction and operation Demonstrate diagnostic procedure Demonstrate adjustments Demonstrate replacement service

LEVEL	Electrical Service	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Adv.	Speed Control Service	Diagnose speed control circuit problems Adjust speed control device Replace or repair defective components	Construction and operation of automatic speed control devices	Discuss speed control construction and operation Demonstrate diagnostic procedure Demonstrate adjustments Demonstrate replacement service
Adv.	Air Conditioning And Ventilating Service	Check operation of air conditioning system Test for refrigerant leaks Check electrical circuits Diagnose mechanical problems Check compressor for oil Remove and replace compressor and related components Evacuate, charge, and test system Remove and replace magnetic clutch Repair magnetic clutch assembly Service temperature control devices Service vacuum controlled dampers	Construction and operation of mechanical components Principles of refrigeration Electrical circuits Temperature control devices Construction and operation of magnetic clutch	Discuss air conditioning function and operation Explain construction and function of mechanical components Discuss temperature control devices Demonstrate use of gauges and test equipment Demonstrate use of Schrader valve adapter Discuss use of special tools Demonstrate use of portable charging unit Demonstrate service procedure

LEVEL	Wheels, Hubs, And Tires	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Tire and Wheel Service	Tire inspection Remove and replace wheels Wheel inspection Tire replacement Stem replacement Tire repair Tube repair	Tire construction and sizes Tire tread types and function Tire wear patterns Types of wheels	Discuss tire construction and sizes Describe tire tread types and function Explain tire inspection Discuss wear patterns Demonstrate wheel and tire replacement Discuss types of wheels Stress left and right hand threads Demonstrate use of tire changing equipment Demonstrate valve stem replacement Discuss and demonstrate tire and tube repair Discuss and demonstrate tire chain use
Basic	Wheel Bearing Service	Remove wheel and hub assembly Remove and clean bearings Inspect components Lubricate bearings Replace and adjust bearing assembly	Types and function of bearings Cleaning solvents Types of seals Types of lubricants	Discuss bearing assemblies and seals Demonstrate removal and inspection procedure Explain cleaning solvents and demonstrate cleaning Discuss lubricants and demonstrate packing Explain and demonstrate hub replacement Stress proper adjustment

CHASSIS

LEVEL	Wheels, Hubs, And Tires	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Wheel Balancing Service	Check wheel balance Balance wheels	Purpose of balancing Static and dynamic balancing Types of balancers	Explain purpose of balancing Discuss static and dynamic balancing Demonstrate use of various types of balancers Explain weight sizes and types Explain rear wheel balancing procedure Stress safety when car is equipped with locking type differentials
Int.	Axle Bearing And Seal Service	Diagnose axle, bearing, and seal problems Remove axle assembly and seals Replace axle bearing assembly Replace inner axle seals Replace axle assembly	Types and functions of bearings Types of seals and function Types of axles	Discuss diagnostic procedure Explain semi- and full-floating axle assemblies Show service procedure Demonstrate puller use Demonstrate use of hydraulic press Demonstrate use of seal pullers and installers Discuss axle shaft end clearance and use of dial indicator Show use of shims
Adv.	Hub Service	Inspect hub and stud assembly Replace studs	Types and sizes of studs	Discuss inspection procedure Discuss stud sizes and types Explain and demonstrate service procedure Check run out Demonstrate use of dial indicator

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LEVEL	Brakes	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Brake Inspection And Adjustment Service	Remove hub and drum assembly Clean and inspect brake assembly Inspect drum and hub assembly Replace drum and hub assembly Adjust brakes Check hydraulic master cylinder	Introduction to brake fundamentals	Demonstrate removal and inspection procedure Discuss brake fundamentals Demonstrate proper replacement Review wheel bearing adjustment Discuss fluid level Discuss and demonstrate brake adjustment Stress the use of proper brake tools
Basic	Brake Shoe Service	Inspect brake assembly Remove brake shoes Clean and lubricate parts as required Replace shoes	Friction materials Function and construction of brake components Lubricants	Review brake fundamentals Explain functions and construction of brake components Demonstrate service procedure Discuss use of service and parts manuals Stress use of proper brake tools
Int.	Drum And Shoe Service	Inspect and measure drums Turn or grind drums Arc shoes	Purpose of drum grinding and turning Purpose of shoe arcing	Discuss and demonstrate inspection and measurement Explain grinding and arcing process Discuss and demonstrate machine set-up Demonstrate drum grinding or turning Demonstrate shoe arcing

LEVEL	Brakes	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Hydraulic Unit Exchange Service	Inspect master cylinder and wheel cylinder Remove master cylinder Remove wheel cylinder Replace hydraulic units Bleed hydraulic system	Hydraulic fundamentals Effects of air in system Construction and operation of hydraulic master cylinder Construction and operation of hydraulic master cylinder Construction and operation of wheel cylinder	Discuss hydraulic fundamentals Discuss effects of air in lines Explain construction and operation of hydraulic units Demonstrate inspection, removal, and replacement Explain and demonstrate bleeding procedure Discuss the use of pressure bleeding equipment Discuss regulations concerning flaring, hydraulic fluids, and line fabrication
Int.	Hydraulic Unit Reconditioning Service	Disassemble hydraulic unit Clean and inspect hydraulic components Recondition hydraulic cylinders	Construction and function of hydraulic units	Preview hydraulic fundamentals Demonstrate disassembly, cleaning, and inspection procedures Explain hydraulic unit construction and function Demonstrate hydraulic cylinder honing Demonstrate reassembly procedure Stress cleanliness
Adv.	Power Brake Service	Diagnose power brake problems Remove power unit Recondition power unit Replace power unit Bleed power unit	Power brake construction and function Vacuum principles	Explain power brake construction and function Discuss diagnostic procedure Demonstrate service procedure Review bleeding operation

CHASSIS

LEVEL	Brakes	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Adv.	Disc Brake Service	Diagnose brake problems Inspect brake assembly Replace friction pads Service caliper assembly Service disc assembly	Construction and function of disc brakes Principles of operation	Explain construction and function of disc brake Discuss principles of operation Explain diagnostic and inspection procedures Demonstrate service procedures

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LEVEL	Springs, Shocks, Stabilizing Devices	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Shock Absorber Service	Inspect and test shock absorbers Remove and replace shock absorbers	Purpose, construction, and operation of a shock absorber Types of shock absorbers	Discuss hydraulic principles Discuss shock operation and construction Explain shock inspection and testing Demonstrate shock service
Int.	Leaf Spring Service	Remove and replace leaf springs Replace spring components	Leaf spring function and construction Types of mounting devices Principles of thrust and torque	Discuss spring construction and function Explain types of mounting devices Discuss principles of thrust and torque Demonstrate service procedures Stress proper jacking and supporting
Int.	Coil Spring Service	Inspect springs Remove and replace coil springs	Coil springs construction and function Types of mounting devices	Discuss coil spring construction and function Demonstrate replacement procedure Review jacking safety
Int.	Torsion Bar Service	Adjust torsion bars Remove and replace torsion bars	Torsion bar construction Types of mounting devices Principles of torsion bar operation	Discuss torsion bar construction, function, and principles Demonstrate replacement procedure Explain and demonstrate adjustment procedure Demonstrate use of height level gauges

LEVEL	Springs, Shocks, Stabilizing Devices	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Sway Bar And Stabilizer Service	Inspect assemblies Replace bushings Replace links Replace sway bars and stabilizer	Principles and construction of stabilizers and sway bars Types of bushings	Review safety precautions Discuss principles and construction Explain types of bushings Demonstrate inspection and service procedures
Adv.	Spring Assist Service	Diagnose suspension problems Install spring assist device	Purpose of spring assists Construction and function of spring assist devices	Discuss purpose and function of spring assists Explain construction and types of spring assists (air lifts, air-hydraulic shocks, helper springs, etc.)

LEVEL	Front Suspension And Steering	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Front Suspension Inspection Service	Inspect front suspension components for wear	Construction of front suspension Front end terms and definitions	Demonstrate component and tire inspection Stress jacking and supporting procedures Explain front suspension construction Discuss front end geometry, terms, and definitions
Basic	Ball Joint Service	Inspect ball joints for wear Remove and replace ball joints	Ball joint function, construction,and types Purpose and operation	Explain inspection service Demonstrate service procedure Review proper jacking and supporting procedure Discuss use of charts and specification information
Int.	King Pin Service	Inspect king pins for wear Remove and replace king pins	King pin function, construction, and types Purpose and operation of king pins	Explain inspecticn service Demonstrate service procedure Review proper jacking and supporting procedure
Int.	Steering Linkage Service	Inspect steering linkage for wear Remove and replace components Adjust toe-in	Steering linkage function, construction, and types Purpose and operation of steering linkage	Explain inspection service Demonstrate service procedure Discuss types and construction of steering linkage Demonstrate toe-in adjustment Stress steering gear centering and proper pitman arm installation Review jacking and supporting procedure

LEVEL	Front Suspension And Steering	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Manual Steering Gear Service	Inspect steering gear for excessive play Adjust steering gear Remove and replace steering gear assembly Overhaul steering gear	Purpose, construction, and function of steering assemblies Operation and types Lubricants used	Explain inspection service Discuss purpose, types, function, and construction of steering gears Stress proper lubrication Demonstrate adjustment procedure Explain and demonstrate service procedures Review steering gear centering and proper pitman arm installation Review front suspension geometry and terms
Int.	Alignment Service	Inspect for parts wear and abnormal tire wear Check and adjust caster and camber Check and adjust toe-in	Front suspension fundamentals Types of front suspensions Types of frame and unit body construction	Explain front suspension types Demonstrate inspection procedure Explain use of special tools Discuss and demonstrate caster and camber adjustment Explain various means of adjusting front suspension angles Review toe-in adjustment
Int.	Front Suspension Overhaul Service	Inspect parts for wear Remove and replace front suspension parts Check and align front end	Function and construction of front suspension components	Discuss front suspension components Demonstrate inspection procedure Explain and demonstrate service procedure Review alignment procedure Discuss use of special tools

LEVEL	Front Suspension And Steering	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Front Suspension Overhaul Service (Cont'd)			Stress safe procedure Review safe jacking and supporting
Adv.	Power Steering Service	Inspect steering gear unit for leaks and excessive play Test system pressures Adjust steering gear Remove and replace steering gear unit Remove and replace pump unit Overhaul power steering pump Overhaul power steering gear Remove and replace control valve assembly (external) Remove and replace external cylinder assembly Service collapsible steering column assembly	Power steering construction, function and,operation Power steering pump construction and operation Types of power steering units Power cylinder contruction and function Collapsible steering column function and construction	Discuss and demonstrate inspection procedure Demonstrate use of test equipment Explain power steering construction, function, and operation Demonstrate service procedures Discuss collapsible steering column construction and service

LEVEL	Clutch	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Clutch Adjustment Service	Inspect and test clutch actuating mechanisms Adjust clutch	Clutch purpose, construction, and function Friction materials Actuating mechanisms	Discuss and demonstrate inspection procedure Explain clutch fundamentals and construction Discuss friction materials Demonstrate adjustment procedures
Int.	Clutch Overhaul Service	Diagnose clutch problems Remove clutch assembly Inspect components Replace pilot bearing Replace clutch components	Types of clutches	Review clutch construction and fundamentals Discuss diagnostic procedures Demonstrate service procedures Explain use of special tools and pullers Review adjustment procedures
Adv.	Hydraulic Cylinder Service	Diagnose clutch hydraulic cylinder problems Remove cylinder assembly Overhaul hydraulic system	Types of hydraulic units Application of hydraulics to clutching systems	Review brake hydraulic system Demonstrate service procedures Explain use of hydraulic bleeding equipment

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LEVEL	Transmission (Manual)	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Manual Transmission Mount Service	Inspect transmission mounts Remove and replace mounts	Transmission mount function and construction Types of mounts	Discuss inspection procedure Demonstrate service procedure
Int.	Manual Transmission Linkage Service	Inspect linkage and bushings Adjust linkage to specifications	Transmission linkage function and construction	Discuss inspection procedure Demonstrate service procedure Explain the use of specification charts and manuals
Int.	Manual Transmission Exchange Service	Diagnose transmission problems Remove and replace transmission Adjust linkage	Transmission fundamentals	Explain diagnostic procedure Discuss transmission fundamentals Stress safety Demonstrate removal and replacement Review adjustment procedure
Int.	Manual Transmission Overhaul Service	Diagnose transmission problems Disassemble transmission Clean and inspect components Replace defective components Assemble transmission	Torque and speed gear ratios Types of gears	Explain diagnostic procedure Review transmission fundamentals Discuss torque and gear ratios Show and discuss various types of gears Demonstrate service procedure Explain use of special tools
Adv.	Overdrive Service	Diagnose overdrive problems Replace defective components	Overdrive fundamentals Construction and operation of overdrive components Electrical service	Explain diagnostic procedure Discuss wiring diagrams Review torque and gear ratio Show and discuss various components

LEVEL	Transmission (Manual)	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Adv.	Overdrive Service (Cont'd.)			Demonstrate service procedures
Adv.	Transfer Case Service	Diagnose transfer case problems Remove and replace transfer case	Purpose of transfer cases and power take-off Transfer case fundamentals	Explain diagnostic procedure Discuss transfer case fundamental
Adv.	Power Take-Off Service	Diagnose power take-off problems Remove and replace power take-off unit Overhaul units	Power take-off fundamentals Construction and operation of transfer cases and power take-off unit	Discuss power take-off fundamentals Show and discuss various components Demonstrate service procedures

LEVEL	Transmission (Automatic)	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Automatic Transmission Inspection Service	Check automatic transmission fluid level Inspect for leaks Change transmission fluid	Types of automatic transmission fluids Causes of fluid loss	Demonstrate procedure for checking fluid level and transmission visual inspection Discuss types of fluids Explain causes for loss of fluid
Int.	Automatic Transmission Exchange And Seal Service	Drain automatic transmission fluid Remove linkage and mounting devices Remove automatic transmission Replace seals Replace transmission Replace linkage and mounting devices	Automatic transmission fundamentals Seal construction and function	Demonstrate automatic transmission fluid draining Discuss automatic transmission fundamentals Explain seal function and construction Discuss and demonstrate service procedures
Adv.	Automatic Transmission Linkage And Band Adjusting Service	Diagnose linkage and band problems Adjust shift and throttle linkage	Shift and throttle linkage purpose Band construction and function	Review automatic transmission fundamentals Explain band construction and function Discuss linkage Demonstrate service procedure Stress proper specifications Explain use of special tools and gauges
Adv.	Automatic Transmission Overhaul Service	Inspect transmission unit Disassemble and inspect components Replace components as necessary	Principles of fluid drive Principles of torque conversion Principles of planetary gearing	Explain inspection procedure Review automatic transmission fundamentals Discuss principles of fluid drive, torque conversion, and planetary gearing

LEVEL	Transmission (Automatic	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Adv.	Automatic Transmission Overhaul Service (Cont'd)	Assemble transmission	Principles of hydraulic control circuit	Demonstrate service procedure Stress proper specifications Explain use of special tools and gauges

LEVEL	Drive Line	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Universal Joint Lubrication And Replacement Service	Inspect universal joints Remove drive shaft Disassemble universal joint Lubricate universal joint and replace parts Assemble universal joint Replace drive shaft	Purpose and construction universal joints Types of universal joints	Explain inspection procedure Discuss purpose and construction of universal joints Demonstrate service procedure Explain and show the use of special tools
Int.	Center Bearing Service	Inspect center bearing Remove drive shaft and center bearing assembly Replace center bearing components and assemble Replace drive shaft assembly Adjust center bearing alignment	Purpose and construction of center bearing assemblies Types of center bearing assemblies	Explain inspection procedure Discuss purpose and construction of center bearings Demonstrate service procedure Explain and show use of special tools
Int.	Drive Shaft Service	Inspect drive shaft assembly Remove drive shaft assembly	Purpose and construction of drive shafts Type of drive shafts	Explain inspection procedure Discuss purpose and construction of drive shafts Explain types of drive shafts and their application Demonstrate service procedure Explain and show the use of special tools and gauges

LEVEL	Drive Axle Assembly	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Basic	Axle Inspection Service	Inspect drive axle assembly for leaks and external damage Check lubricant level Fill to proper level	Purpose and construction of drive axles Check lubricant level Fill to proper level	Explain inspection procedure Discuss purpose and construction of drive axles Explain hypoid gearing Demonstrate lubrication service Stress use of proper lubricants
Basic	Pinion Seal Service	Inspect pinion assembly for leaks Replace pinion seal Check lubricant level Fill to proper level	Purpose and construction of pinion seals	Explain inspection procedure Discuss purpose and construction of pinion seals Demonstrate service procedure Review drive axle lubrication
Basic	Differential Assembly Exchange Service	Inspect differential assembly Remove axle assembly Remove and replace differential assembly Replace axle assembly Check lubricant level Fill to proper level	Purpose and construction of the differential assembly	Explain inspection procedure Discuss purpose and construction of differentials Discuss differential fundamentals Demonstrate service procedures Preview drive axle lubrication
Int.	Differential Assembly Overhaul Service	Inspect differential assembly Disassemble differential assembly Clean and inspect components Replace worn components Assemble and adjust differential assembly	Component function and nomenclature Gear ratios Types of gears Function and construction nonslip differentials	Explain inspection procedure Review differential fundamentals Review purpose and construction of differentials Discuss gear ratios and gear types Discuss component function and nomenclature

LEVEL	Drive Axle Assembly	APPLICATION	CONCEPTS	TEACHING SUGGESTIONS
Int.	Differential Assembly Overhaul Service (Cont'd			Demonstrate service procedure Demonstrate pinion preload, backlash, and gear tooth contact adjustments
Adv.	Transaxle Service	Inspect transaxle assembly Diagnose operating problems Remove and replace transaxle assembly Overhaul transaxle assembly	Purpose and construction of transaxle assemblies Transaxle applications	Explain inspection procedures Discuss purpose and construction of transaxles Demonstrate diagnostic procedures Discuss transaxle applications Explain and demonstrate removal and replacement procedures Demonstrate overhaul procedures
Adv.	Front Drive Service	Inspect front drive assembly Diagnose operating problems Remove and replace axle assemblies Overhaul drive assembly	Purpose and construction of front drive assemblies Front drive applications Driving and steering axle principles Constant velocity universal joints	Explain inspection procedures Discuss purpose and construction of front drive assemblies Explain front drive fundamentals Review universal joint principles Discuss front drive application Review differential assemblies Explain and demonstrate service procedures